LG Chem Yeosu Complex	Material Safety Data Sheet	Identity No.	GHS – 3AA - 001
	ACRYLIC ACID **CAS No. : 79-10-7**	Pages	1/12

1. Identification of the product and the supplier

1) Product name : ACRYLIC ACID

2) Advisable use and Restriction
○ Advisable use :
- Acrylic Esters, SAP(Super Absorbent Polymer), Cross-linking Agent, Chemical Intermediates

○ Restriction of product using : Not available

3) Manufacturer/Supplier/Distributor information
○ Company : LG Chem, LTD. Acrylate plant
○ Address : 451, Sandanjungang-ro, Yeosu-si, Jeollanam-do
○ Emergency response number : 061-680-6910
○ Respondent : 3AA Team

2. Hazard identification

1) Hazard classification :

- Flammable liquid :	Category 3
- Corrosive to Metals:	Category 1
- Acute toxicity (oral) :	Category 1
- Acute toxicity (dermal) :	Category 2
- Acute Toxicity(inhalation: vapour) :	Category 3
- Skin corrosion/irritation :	Category 1
- Eye Damage/Irritation :	Category 1
- Skin sensitization :	Category 1
- Target Organ Systemic Toxicity(single exposure) :	Category 3 (respiratory irritation)
- Target Organ Systemic Toxicity(repeated exposure) :	Category 2
- Acute aquatic toxicity :	Category 1

2) Allocation label elements
○ Pictogram and symbol

○ Signal word : Danger
○ Hazard statement
H226 Flammable liquid and vapour
H290 May be corrosive to metals
H302 Harmful if swallowed
H311 Toxic in contact with skin
H331 Toxic if inhaled
H314 Causes severe skin burns and eye damage
H318 Causes serious eye damage

H317 May cause an allergic skin reaciton
H335 May cause respiratory irritation
H373 May cause damage to organs through prolonged or exposure
H400 Very toxic to aquatic life

○ Precautionary statements

- Prevention: P210: Keep away from flames and hot surfaces. - No smoking
  P233: Keep container tightly closed.
  P240: Ground/bond container and receiving equipment.
  P241: Use explosion-proof electrical/ventilating/lighting/ equipment.
  P242: Use only non-sparking tools.
  P243: Take precautionary measures against static discharge.
  P280: Wear protective gloves/protective clothing/eye protection/face protection.
  P234: Keep only in original container.
  P264: Wash thoroughly after handling.
  P270: Do not eat, drink or smoke when using this product.
  P261+P260: Avoid breathe and do not breathe dust/fume/gas/mist/vapours /spray.
  P271: Use only outdoors or in a well-ventilated area.
  P272: Contaminated work clothing should not be allowed out of the workplace.
  P273: Avoid release to the environment.

- Response: P303+P361+P353: If on skin (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
  P370+P378: In case of fire: Use for extinction.
  P390: Absorb spillage to prevent material damage.
  P301+P312: IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell.
  P302+P352+P322: IF ON SKIN: Wash with plenty of soap and water. Specific measures.
  P361: Remove/Take off immediately all contaminated clothing.
  P363: Wash contaminated clothing before reuse.
  P304+P340: If inhaled: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
  P311+P321: Call a POISON CENTER or doctor/physician. Specific treatment.
  P301+P330+P331: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
  P310: Immediately call a POISON CENTER or doctor/physician.
  P305+P351+P338: In IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and wash to do. Continue rinsing.
  P333+P313: If skin irritation or rash occurs: Get medical advice/attention.
  P314: Get medical advice/attention if you feel unwell.
  P391: Collect spillage.

- Storage : P403+P235+P233 : Store in a well-ventilated place. Keep container tightly closed and cool.
  P406: Store in corrosive resistant/ container with a resistant inner liner.
  P405: Store locked up.

- Disposal : P501: Dispose of contents/container to in accordance with local/regional/ national/international regulations (to be specified).

3) Other hazard information not included in hazard classification
   - NFPA Rating system : Health: **3,** Flammability: **2,** Reactivity: **2**

3. Composition/information on ingredients

Chemical Name	Common name Synonyms	CAS No.	Content (%)
ACRYLIC ACID	ACROLEIC ACID 2-PROPENOIC ACID VINYLFORMIC ACID	79-10-7	>= 99.5

4. First-aid measures

1) Eye contact :
-Remove contact lenses if present and easy to do.
-Get immediate medical advice/attention if irritating, pain, swelling, tear, dazzling eyes occur.
-Wash eyes immediately with large amounts of water.

2) Skin contact
-Wash off immediately with plenty of water and soap for at least 15 minutes.
-Wash and dry carefully contaminated clothing and shoes before reuse.
-In case of contact with chemicals, get immediate medical advice/attention.

3) Inhalation
-Move victims immediately to place with fresh air and not contaminated area.
-If not breathing, give artificial respiration and have a trained individual administer oxygen.
-Get medical attention immediately if inhaled.

4) Ingestion
-If swallowed, immediately call a POISON CENTER or doctor/physician.
-Do NOT induce vomiting.

5) Acute and delayed symptoms/effects
-Inhalation:
short-term exposure: May cause severe irritation of respiratory organs, pulmonary edema.
-Skin contact :
short-term exposure: May cause corrosive and irritation.
-Eye contact :
short-term exposure: May cause irritation and corrosive of corneal.

6) Indication of immediate medical attention and notes for physician
-Move victim to fresh air.
-Give artificial respiration if victim is not breathing.
-Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
-Call 911 or emergency medical service.
-Administer oxygen if breathing is difficult.
-Remove and isolate contaminated clothing and shoes.
-In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
-Keep victim warm and quiet.
-Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
-Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

5. Fire-fighting measures

1) Suitable (and unsuitable) extinguishing media
○ suitable extinguishing media:
-Small fire: Dry chemical, CO_2, water spray or alcohol-resistant foam
-Large fire: Water spray, fog or alcohol-resistant foam
○ unsuitable extinguishing media: Do not use straight streams
○ In case of major fire and large quantities:
-Move containers from fire area if you can do it without risk.
-Dike fire-control water for later disposal; do not scatter the material.
-Some of these materials may react violently with water.
○ tank/trailer/train truck fire:
-Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
-Cool containers with flooding quantities of water until well after fire is out.
-Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
-ALWAYS stay away from tanks engulfed in fire.
-For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.
-If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

2) Specific hazards arising from the chemical
○ Thermal decomposition products : irritating, corrosive and/or toxic gases, Carbon oxides
○ Fires and an explosion
-Flammable/combustible material.
-May be ignited by heat, sparks or flames.
-Vapors may form explosive mixtures with air.
-Vapors may travel to source of ignition and flash back.
-Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
-Vapor explosion hazard indoors, outdoors or in sewers.
-Runoff to sewer may create fire or explosion hazard.
-Containers may explode when heated.
-Many liquids are lighter than water.

3) Special protective equipment and precautions for fire-fighters
-Wear positive pressure self-contained breathing apparatus (SCBA).
-Wear chemical protective clothing that is specifically recommended by the manufacturer. It may provide little or no thermal protection.
-Structural firefighters' protective clothing provides limited protection in fire situations ONLY; it is not effective in spill situations where direct contact with the substance is possible.

6. Accidental release measures

1) Personal precautions, protective equipment and emergency procedures
-CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number listed on the inside back cover.
-As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.
-Keep unauthorized personnel away.
-Stay upwind.
-Keep out of low areas.
-Ventilate closed spaces before entering.

2) Environmental precautions and protective procedures
○ Atmosphere : Provide local exhaust ventilation system.
○ Land : Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
○ Underwater : Prevent entry into waterways, sewers, basements or confined areas.

3) The methods of purification and removal
○ Small spill
-Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
-ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area).
-All equipment used when handling the product must be grounded.
-Do not touch or walk through spilled material.
-Stop leak if you can do it without risk.
-Absorb with earth, sand or other non-combustible material and transfer to containers (except for Hydrazine).
-Use clean non-sparking tools to collect absorbed material.

○ Large spill
-Dike far ahead of liquid spill for later disposal.
-Water spray may reduce vapor; but may not prevent ignition in closed spaces.
-Prevent entry into waterways, sewers, basements or confined areas.
-A vapor suppressing foam may be used to reduce vapors.
-Keep unauthorized personnel away.

7. Handling and storage

1) Precautions for safe handling
-Do not breathe gas/fumes/vapours/spray.
-Wash thoroughly after handling.
-Wear suitable protective clothes and face shield.
-Avoid contact with skin, eyes and cloths.

-DO NOT eat, drink or smoke in product area.
-Use certificated protective equipment.

2) Conditions for safe storage
-Store locked up.
-Keep away ignition sources.
-Keep in well-ventilated place.

8. Exposure controls/personal protection

1) Occupational Exposure Limits
○ Regulation in Korean: TWA : 2ppm(6mg/m^3)
○ US (NIOSH/OSHA AGGIH):
- NIOSH- TWA: 2ppm
- OHSA- TWA: 10ppm, OES: 30mg/m^3〔10ml/m^3)
- ACGIH- TWA: 2ppm
TWA(AUS)= 10ppm

○ Biological Exposure Index: Not available

2) Appropriate engineering controls
-Provide local exhaust ventilation system or other engineering controls to keep the airborne concentrations of vapours below their respective threshold limit value.
-Check legal suitability of exposure level.

3) Personal protective equipment
○ Respiratory protection
-Respiratory protection: Wear NIOSH/MESA approved full or half face piece (with goggles) respireatory protective equipment.

○ Eye protection
-Wear facepiece with goggles to protect from scattering dust or toxic liquid.
-Further eye protection such as chemical goggles and/or protecting glasses must be worn when the possibility exists for eye contact due to splashing or spraying liquid or airborne particle.

○ Hand protection
-Wear appropriate chemical-resistant gloves that protect chemicals directly.

○ Body protection
-Wear appropriate protective chemical-resistant clothing.

9. Physical and chemical properties

1) Appearance	Physical state : Liquid Color : Colorless
2) Odor	Acrid odor
3) Threshold of odor	1.04 ppm
4) pH	2.5 (10% solution)
5) Melting point/freezing point	14 ˚C

6) Initial boiling point and boiling range	141 ˚C at 1,013 hPa (DIN 51 751)
7) Flash point	48-55 ˚C (DIN 51 755)
8) Evaporation rate	Not available
9) Flammability (solid, gas)	Flammable liquid
10) Upper/lower flammability or explosive limits.	Lower: 2.4% Upper: 8.0%
11) Vapour pressure	3.8 hPa at 20 ˚C
12) Solubility(ies)	1000 g/L (25 ˚C)
13) vapour density	2.5 (AIR= 1)
14) Specific gravity	1.0621 g/cm3 at 20 ˚C
15) n-octanol/water partition coefficient	log Kow= 0.38 at 25 ˚C (OECD TG 107)
16) Auto ignition temperature	395 ˚C
17) Degradation temperature	Not available
18) Viscosity	Not available
19) Molecular weight	72.06g/mol

10. Stability and reactivity

1) Chemical stability
-Stable under normal temperatures and pressures

2) Possibility of hazardous reactions
-Forms explosive mixtures with air.
-Those substances may polymerize explosively or intensely.
-Hazardous polymerization may occur if heated.
-Avoid heat, Avoid oxygen content above the product less than 5%.
-Closed containers may explode in a violent.
-Do not blanket with nitrogen

3) Conditions to avoid
-Containers may explode when heated.
-Avoid heat, sparks, open flames, or other sources of ignition.
-Put away from water supply and sewage.

4) Incompatible materials
-acid, base, amines, peroxides, combustible materials, metals, cyanides, reducing agent, metallic salts, oxidants, peroxides

5) Hazardous decomposition product
-Thermal decomposition product : irritating, corrosive and/or toxic gases, Carbon oxides

11. Toxicological information

1) Information on the likely routes of exposure
○ Inhalation:
short-term exposure: May cause severe irritation of respiratory organs, pulmonary edema.
○ Skin contact :
short-term exposure: May cause corrosive and irritation.
○ Eye contact :
short-term exposure: May cause irritation and corrosive of corneal.

2) Symptoms related to the physical, chemical and toxicological characteristics
-Flammable liquid: Category 3
-Corrosive to Metals: Category 1
-Explosives, Pyrophoric, Water reactive substances, Organic peroxides: Not applicable (no relevance to molecular structure)
-Refer to "5) Acute and delayed symptoms/effects" of "4.First aid measures"

3) Delay by short term and long term exposures, acute and chronic effect
○ Acute toxicity - Oral : Category 4, LD_{50}= 718-1337mg/kg (Rat) (GLP)
- Dermal : Category 3, LD_{50}= 640mg/kg (Rabbit)
- Inhalation : Category 3, LC_{50}= 3.6mg/L/4hours (Rat)

○ Skin Corrosion/ Irritation: Category 1
- Acrylic acid causes skin corrosion and irritation of the respiratory tract in humans. Or It causes skin corrosion in rabbits.

○ Serious Eye Damage/ Irritation: Category 1
- Acrylic acid tested by application to rabbit eyes with special attention to degree of corneal damage caused injury graded 9 on a scale with the maximum of 10. Or based on the description in the report on eye irritation tests: cicatrices in the eyelids and corneal opacity are still evident after 20 days of the application, both of which are considered irreversible effects.

○ Respiratory sensitizer: Not available

○ Skin Sensitization: Category 1
- The guinea pigs indicate skin sensitisation in maximization test . Skin sensitisation was observed in humans.

○ Carcinogenecity: Not classified
- IARC: 3A, ACGIH-A4
- NTP, OSHA, Regulation 1272/2008, US EPA: Not listed
- Acrylic acid is not suspected to be a carcinogenic agent
(Based on these data, carcinogenic effects are not anticipated to occur.)

○ Mutagenicity: Not classified
In vitro – Bacterial ames test(S. typhimurium): Negative
- Cytogenetic assay(Chinese Hamster Ovary Cells): Positive
- Mouse lymphoma assay(L5178Y-cells): Positive
- UDS(unscheduled DNA Synthesis) Test: Negative
- Chromosomal aberrations test(Chinese Hamster Ovary Cells): Negative

In vivo - Cytogenetic assay, inhalation: Negative (GLP)
- Micronucleus assay(rat bone marrow): Negative

○ Reproductive toxicity: Not classified
- Rat(Fischer 344)/Acrylic acid was administered at doses of 0, 0.083, 0.25, and 0.75 g/kg/d in groups of 10 male and 20 female rats for 90 days after which the animals were mated. Treatment-related effects increase/decrease body weight gain, and reduced food & water consumption in F0 rats at the 2 highest dose levels. Organ weight changes occurred in both F0 & F1 animals & reduced body weight gain was seen in the F1 pups at the highest level. No statistically significant changes in reproductive indices were observed.

○ Specific target organ toxicity (single exposure): Category 3(Respiratory irritation)
- Rat/Based on the animal studies including "degeneration and necrosis of liver tissue (oral route); severe irritation of respiratory organs, pulmonary inflammation (inhalation route); pulmonary edema (dermal route)

○ Specific target organ toxicity (repeat exposure): Category 2
- Gavage treatment with acrylic acid for 90 days revealed dose dependent mortality, irritation and ulceration of the stomach, and renal tubular necrosis in rats (NOAEL=25ppm). Body weight gains were significantly decreased in female mice in the 25- and 75-ppm groups after 12 weeks of exposure. Nasal lesions, consisting of slight focal degeneration of the olfactory epithelium, occurred in all but three male rats of the 75-ppm group and in at least some mice at all exposure levels. No adverse effects on clinical chemistries or hematology were detected in any dose group.

○ Aspiration hazard: Not available

12. Ecological information

1) Aquatic Ecotoxicity
-Acute toxicity: Category 1
-Chronic toxicity: Not classified
○ Fish : 96hr-LC_{50}*(Salmo gairdneri)* = 27mg/l (OECD TG 203, GLP)
○ Crustacea: : 48hr-EC_{50}*(Daphnia magna)* = 47mg/l
21d-NOEC = 12mg/l
○ Algae : 96hr-ErC_{50}*(Selenastrum capricornutum)* = 0.13mg/l (GLP)

2) Persistence and degradability
○ Persistence : Acrylic acid exists only as a vapor in the atmosphere.
(Vapour pressure=3.97mmHg)

12. Ecological information

○ Degradability
-Hydrolysis: Acrylic acid is stable to hydrolysis at pH 3, 7, and 11.
-Photolysis: The estimated range of atmospheric half-life is 39.6 hours (2 days)

3) Bioaccumulative potential
○ Biodegradation : readily biodegradation, 81% biodegradation after 28days (OECD 301C, Modified MITI Test(I))
○ Bioaccumulation : Low Bioaccumulation (BCF=3.162 (estimated), log Kow= 0.38)

4) Mobility in soil
- low potency of mobility to soil (Koc=43L/kg)

13. Disposal considerations

1) Disposal method
-Incinerate waste.
-Incinerate residues after treatment by methods of evaporation and condensation.
-Incinerate residues after purification by methods of separation, distillation, extraction and filtration.
-Treat with reactions such as neutralization, oxidation, reduction, polymerization and condensation.
-Incinerate residues after treatment by the methods of cohesion, precipitation, filter and dehydration.
2) Disposal precaution
-Consider the require attentions in accordance with waste treatment management regulation.

14. Transport information

1) UN Number : UN 2218
2) UN Proper shipping name : ACRYLIC ACID, STABILIZED
3) Transport Hazard class : Class 8(3), (IMDG Code Flash point : 54℃ o.c)
4) Packing group : II
5) Marine pollutant : Applicable
6) Special safety response for transportation or transportation measure
○ Emergency schedule for fire : F-E
○ Emergency schedule for spillage : S-C

15. Regulatory information

○ Korea
- Korea Occupational Safety and Health Regulation: Listed in occupational exposure assessment, Hazardous agent, Occupational exposure limits and Health examination agent
- Toxic Chemical Control Act. : Listed in Substances requiring preparation for accidents
- Dangerous Material Safety Management Regulation : Petroleum, class 4-2(water solubility liquid, 2000L)
- Waste Control Act. : Public Controlled Waste (Waste acid or waste alkali)

15. Regulatory information

○ EU Classification
- Classification: R10 Xn; R20/21/22 C; R35 N; R50
- Risk phrases : R10, R20/21/22, R35, R50
- Safety phrases : S1/2, S26, S36/37/39, S45, S61

○ U.S.A. management information
- OSHA regulation (29CFR1910.119) : Not applicable
- CERCLA 103 regulation (40CFR302.4) : 2267.995 kg 5000 lb
- EPCRA 302 regulation (40CFR355.30) : Not applicable
- EPCRA 304 regulation (40CFR355.40) : Not applicable
- SARA 313 regulation (40CFR372.65) : Not applicable

○ Rotterdam Convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade : Not applicable

○ Stockholm Convention on Persistent Organic Pollutants (POPs) : Not applicable

○ Mont- real Protocol on Substances that Delete the Ozone Layer : Not applicable

16. Other information

1) Information source and references:

- ECB-ESIS (European chemical Substances Information System) (http://ecb.jrc.it/esis)
- International Uniform Chemical Information Database (IUCLID) (http://ecb.jrc.it/esis)
- IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (http://monographs.iarc.fr/ENG/Classification/ClassificationsCASOrder.pdf)
- NTP (National Toxicology Program) (http://ntp.niehs.nih.gov/)
- REGULATION (EC) No 1272/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008
- Korea Occupational Health & Safety Agency: http://www.kosha.net
- U.S. National library of Medicine (NLM) Hazardous Substances Data Bank (HSDB): (http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB.htm)
- U.S. EPA (U.S. Environmental Protection Agency) (http://www.epa.gov/)
- The Estimation Programs interface (EPI) Suites, Syracuse Research Corporation
- NITE (National Institute of Technology and Evaluation) http://www.safe.nite.go.jp/english/ghs_index.html#manual
- Waste Control Act enforcement regulation attached [1]
- Korea dangerous material inventory management system (http://hazmat.nema.go.kr)
- National chemicals information systems (http://ncis.nier.go.kr)

2) Issue date : 2012. 6. 25.

3) Revision number and date : 1997. 1. 20 (12th)

4) Other material safety data sheet information:
LG Chem LTD., Korea Occupational Health & Safety Agency

<History>

Rev. No.	Category	Revision Issue	Date	Respondent
8	ALL	Team leder Change	2006.01.15	Park chan kyo
9	1.3	Emergency response number Change	2007.11.23	Park chan kyo
10	ALL	For GHS Rule	2010.06.21	Park chan kyo
11	2.1	Hazard classification revise	2011.08.26	Yu seul bin
12	14. 3	IMDG Code Flash Point update	2012. 6. 25	Yu seul bin
13	10. 2	Possibility of hazardous reactions revise	2013. 10. 01	Gwak byeong soo
14	1.3	Address and Emergency response number change	2014.02.27	Gwak Byeongsoo